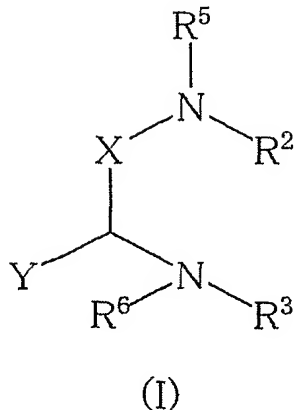


C L A I M S

1. A compound of the formula (I):



5 wherein

X is -CO- or -(CH₂)_k- (wherein k is 1, 2 or 3);

Y is

(1) lower alkyl, or

10 (2) Z-(CH₂)_n-,

{wherein

Z is

(1) aryl, or

(2) R¹-CO-NR⁴-

15 (wherein

R¹ is (1) aryl, heterocyclyl,

aryl-(lower alkyl),

aryl-(lower alkoxy), or

heterocyclyl-(lower alkoxy),

20 each of which may be substituted with one or more substituent(s) selected from the group consisting of

(a) lower alkyl,

25 (b) halogen and

(c) hydroxy; or

(2) lower alkoxy; and
R⁴ is hydrogen, or lower alkyl); and
n is 1, 2, 3, 4, 5 or 6};

5 R² is (1) lower alkyl, aryl-(lower alkyl) or
(lower alkyl)thio-(lower alkyl),
each of which may be substituted with one
or more substituent(s) selected from the
group consisting of
10 (a) heterocyclyl,
(b) carboxy,
(c) carboxy-(lower alkyl),
(d) amidated carboxy,
(e) (lower alkoxy)carbonyl which may be
15 substituted with cycloalkyl,
heterocyclyl or (lower alkanoyl)oxy;
and
(f) cyano; or
(2) aryl which may be substituted with
20 lower alkyl, lower alkenyl, aryl,
lower alkoxy, (lower alkyl)amino,
(lower alkyl)thio, carboxy,
(lower alkoxy)carbonyl,
(lower alkoxy)-(lower alkyl),
25 (lower alkyl)amino-(lower alkyl), or
(lower alkyl)thio-(lower alkyl),
each of which may be further substituted with
one or more substituent(s) selected from the
group consisting of
30 (a) heterocyclyl,
(b) (lower alkoxy)carbonyl,
(c) carboxy and
(d) amidated carboxy;
35 R³ is (1) -Q-R⁷,

[wherein

Q is -CO- or -SO₂-,

R⁷ is (a) lower alkyl which may be substituted with
one or more substituent(s) selected from the
group consisting of
cycloalkyl,
aryl which may be further substituted with
aryl(s), and
heterocyclyl,

(b) lower alkenyl which may be substituted with
one or more substituent(s) selected from
the group consisting of aryl and
heterocyclyl,

(c) cycloalkyl,

(d) aryl which may be substituted with one or
more substituent(s) selected from the group
consisting of

lower alkyl,
aryl which may be further substituted with
hydroxy(s),
lower alkoxy,
aryloxy,
hydroxy, and
halogen,

(e) heterocyclyl which may be substituted with
one or more substituent(s) selected from the
group consisting of

lower alkyl,
aryl which may be further substituted with
halogen(s), and
halogen,

(f) aryloxy, or

(g) amino which may be substituted with aryl(s)
which may be further substituted with one
or more substituent(s) selected from the

group consisting of aryl and heterocyclyl];
or

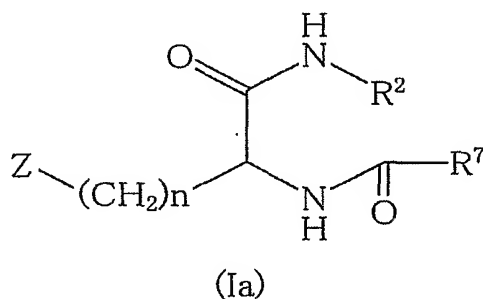
(2) lower alkyl which may be substituted with
aryl(s) or heterocyclyl(s), each of which
5 may be further substituted with aryl(s); and

R⁵ and R⁶ are independently hydrogen or lower alkyl;
or

10 R⁶ and Y may be linked together to form -(CH₂)_m- (wherein
m is 2, 3, 4 or 5);

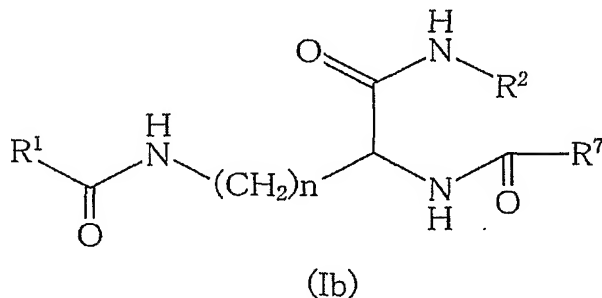
or a pharmaceutically acceptable salt thereof.

15 2. A compound of claim 1 having the formula (Ia):



wherein Z, R², R⁷ and n are as defined above.

3. A compound of claim 1 having the formula (Ib):



20 wherein R¹, R², R⁷ and n are as defined above.

4. A compound of claim 3,
wherein

R¹ is aryl-(lower alkoxy);

R² is lower alky, or

5 aryl which may be substituted with
carboxy-(lower alkyl);

R⁷ is heterocyclyl which may be substituted with
substituted with lower alkyl; and

n is 1, 2, 3, 4 or 5.

10

5. A compound selected from:

sodium 6-[(2S)-2-[(1-benzofuran-2-yl-carbonyl)
amino]-5-[benzyloxycarbonylamino]pentanoylamino]-
hexanoate,

15 (2E)-3-{2-[(2S)-2-[(1H-indol-2-ylcarbonyl) amino]-5
-[benzyloxycarbonylamino]pentanoylamino]phenyl}-
acrylic acid,

(2E)-3-{2-[(2S)-2-[(1-methyl-1H-indol-2-yl-
carbonyl) amino]-5-[benzyloxycarbonylamino]-

20 pentanoylamino]phenyl}acrylic acid,

3-{2-[(2S)-2-[(1-methyl-1H-indol-2-ylcarbonyl)-
amino]-5-[benzyloxycarbonylamino]pentanoylamino]-
phenyl}propanoic acid,

sodium 3-{2-[(2S)-2-[(2-quinolinylcarbonyl) amino]-
25 5-[benzyloxycarbonylamino]pentanoylamino]phenyl}-
propanoate,

6-[(2S)-2-[(1-benzofuran-2-ylcarbonyl) amino]-5-
{[(benzyloxy) carbonyl] amino}pentanoyl) amino]-2-
naphthoic acid,

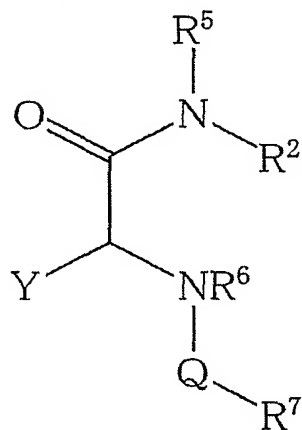
30 3-{2-[(2S)-5-{[(benzyloxy) carbonyl] amino}-2-{[(8-
methylimidazo[1,2-a]pyridin-2-yl) carbonyl] amino}-
pentanoyl) amino]phenyl}propanoic acid,

3-[2-[(2S)-5-{[(benzyloxy) carbonyl] amino}-2-
[(2-quinolinylmethyl) amino]pentanoyl) amino]-

35 phenyl}propanoic acid, and

3-[2-({(2S)-5-{[(benzyloxy)carbonyl]amino}-2-[(1H-indol-2-ylcarbonyl)amino]pentanoyl}amino)phenyl]-propanoic acid.

- 5 6. A process for preparing the compound of the formula (Ia-1):



(Ia-1)

wherein

Y is

- 10 (1) lower alkyl, or
 (2) Z-(CH₂)_n-,

{wherein

Z is

- (1) aryl, or
 15 (2) R¹-CO-NR⁴-

(wherein

R¹ is (1) aryl, heterocyclyl,

aryl-(lower alkyl),

aryl-(lower alkoxy), or

- 20 heterocyclyl-(lower alkoxy),
 each of which may be substituted
 with one or more substituent(s)
 selected from the group
 consisting of

- (a) lower alkyl,
- (b) halogen and
- (c) hydroxy; or
- (2) lower alkoxy; and

5 R^4 is hydrogen, or lower alkyl); and
n is 1, 2, 3, 4, 5 or 6};

Q is -CO- or -SO₂-;

10 R^2 is (1) lower alkyl, aryl-(lower alkyl) or
 (lower alkyl)thio-(lower alkyl),
 each of which may be substituted with one
 or more substituent(s) selected from the
 group consisting of
15 (a) heterocyclyl,
 (b) carboxy,
 (c) carboxy-(lower alkyl),
 (d) amidated carboxy,
 (e) (lower alkoxy)carbonyl which may be
20 substituted with cycloalkyl,
 heterocyclyl or (lower alkanoyl)oxy;
 and
 (f) cyano; or
 (2) aryl which may be substituted with
25 lower alkyl, lower alkenyl, aryl,
 lower alkoxy, (lower alkyl)amino,
 (lower alkyl)thio, carboxy,
 (lower alkoxy)carbonyl,
 (lower alkoxy)-(lower alkyl),
30 (lower alkyl)amino-(lower alkyl), or
 (lower alkyl)thio-(lower alkyl),
 each of which may be further substituted with
 one or more substituent(s) selected from the
 group consisting of
35 (a) heterocyclyl,

- (b) (lower alkoxy)carbonyl,
- (c) carboxy and
- (d) amidated carboxy;

5 R⁵ and R⁶ are independently hydrogen or lower alkyl;
or

R⁶ and Y may be linked together to form -(CH₂)_m- (wherein
m is 2, 3, 4 or 5); and

10

R⁷ is (a) lower alkyl which may be substituted with
one or more substituent(s) selected from the
group consisting of

cycloalkyl,

15

aryl which may be further substituted with

aryl(s), and

heterocyclyl,

(b) lower alkenyl which may be substituted with
one or more substituent(s) selected from the
group consisting of aryl and heterocyclyl,

20

(c) cycloalkyl,

(d) aryl which may be substituted with one or
more substituent(s) selected from the group
consisting of

25

lower alkyl,

aryl which may be further substituted with

hydroxy(s),

lower alkoxy,

aryloxy,

30

hydroxy, and

halogen,

(e) heterocyclyl which may be substituted with
one or more substituent(s) selected from the
group consisting of

35

lower alkyl,

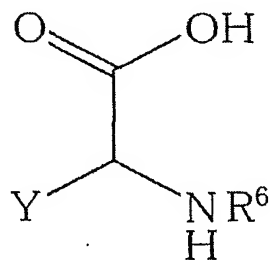
aryl which may be further substituted with
halogen(s), and
halogen,

(f) aryloxy, or

5 (g) amino which may be substituted with aryl(s)
which may be substituted with one or more
substituent(s) selected from the group
consisting of aryl and heterocyclyl];

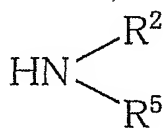
10 or a pharmaceutically acceptable salt thereof,

comprising, reacting a compound (IIa):



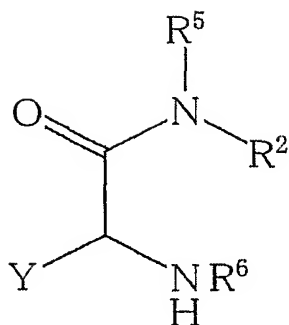
(IIa)

(wherein Y and R⁶ are each as defined above), or its
15 reactive derivative at the carboxy group or the salt
thereof, with a compound (IIIa):



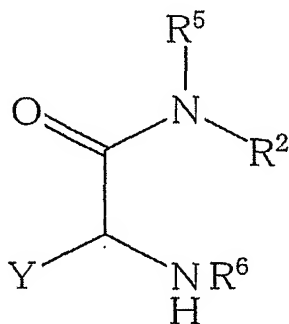
(IIIa)

(wherein R² and R⁵ are each as defined above), or its
reactive derivative at the amino group or the salt
20 thereof to give a compound (IVa):



(IVa)

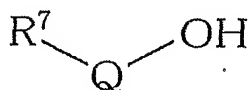
(wherein Y, R², R⁵ and R⁶ are each as defined above),
 or its salt; and
 reacting the compound (IVa):



(IVa)

5

(wherein Y, R², R⁵ and R⁶ are each as defined above),
 or its salt, with a compound (V):



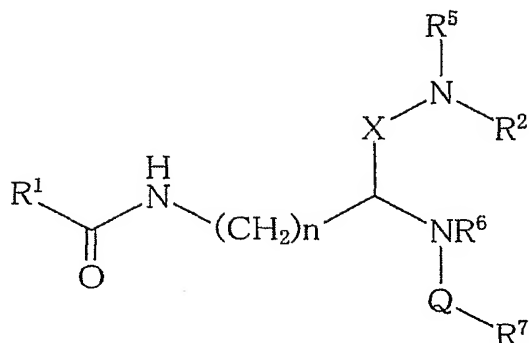
(V)

10

(wherein Q and R⁷ are each as defined above), or its
 reactive derivative at the carboxy group (in case of
 Q is -CO-)/the sulfo group (in case of Q is -SO₂-), or
 the salt thereof.

15

7. A process for preparing the compound of the formula
 (Ib-1):



(Ib-1)

wherein

X is -CO-, or -(CH₂)_k- (wherein k is 1, 2 or 3);

5 Q is -CO- or -SO₂-;

R¹ is (1) aryl, heterocyclyl, aryl-(lower alkyl),
 aryl-(lower alkoxy), or
 heterocyclyl-(lower alkoxy),

10 each of which may be substituted with one
 or more substituent(s) selected from the
 group consisting of

(a) lower alkyl,

(b) halogen and

15 (c) hydroxy; or

(2) lower alkoxy; and

R² is (1) lower alkyl, aryl-(lower alkyl) or
 (lower alkyl)thio-(lower alkyl),

20 each of which may be substituted with one
 or more substituent(s) selected from the
 group consisting of

(a) heterocyclyl,

(b) carboxy,

25 (c) carboxy-(lower alkyl),

(d) amidated carboxy,

(e) (lower alkoxy)carbonyl which may be substituted with cycloalkyl, heterocyclyl or (lower alkanoyl)oxy; and

5 (f) cyano; or

(2) aryl which may be substituted with lower alkyl, lower alkenyl, aryl, lower alkoxy, (lower alkyl)amino, (lower alkyl)thio, carboxy,

10

(lower alkoxy)carbonyl, (lower alkoxy)-(lower alkyl), (lower alkyl)amino-(lower alkyl), or (lower alkyl)thio-(lower alkyl),

15

each of which may be further substituted with one or more substituent(s) selected from the group consisting of

- (a) heterocyclyl,
- (b) (lower alkoxy)carbonyl,
- (c) carboxy and
- 20 (d) amidated carboxy;

20

R⁵ and R⁶ are independently hydrogen or lower alkyl; or

25

R⁶ and Y may be linked together to form -(CH₂)_m- (wherein m is 2, 3, 4 or 5);

R⁷ is (a) lower alkyl which may be substituted with one or more substituent(s) selected from the group consisting of

30

cycloalkyl, aryl which may be further substituted with aryl(s), and heterocyclyl,

35

(b) lower alkenyl which may be substituted with

one or more substituent(s) selected from the group consisting of aryl and heterocyclyl,

(c) cycloalkyl,

5 (d) aryl which may be substituted with one or more substituent(s) selected from the group consisting of

lower alkyl,

aryl which may be further substituted with hydroxy(s),

10 lower alkoxy,

aryloxy,

hydroxy, and

halogen,

(e) heterocyclyl which may be substituted with one or more substituent(s) selected from the group consisting of

lower alkyl,

aryl which may be further substituted with halogen(s), and

20 halogen,

(f) aryloxy, or

(g) amino which may be substituted with aryl(s) which may be substituted with one or more substituent(s) selected from the group consisting of aryl and heterocyclyl]; and

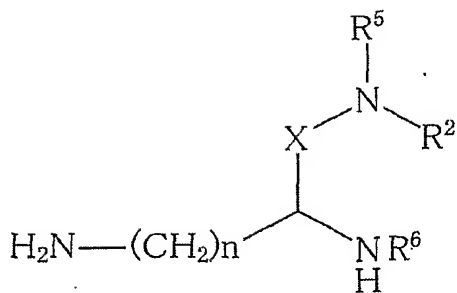
25

n is 1, 2, 3, 4, 5 or 6;

or a pharmaceutically acceptable salt thereof,

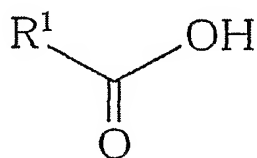
30

comprising, reacting a compound (IIb):



(IIb)

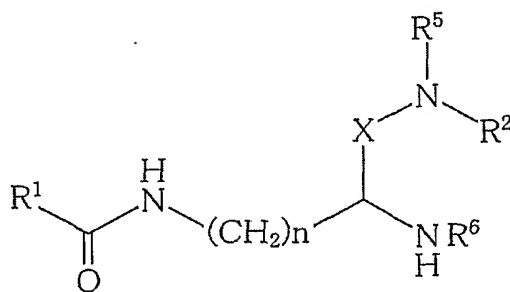
(wherein X, R², R⁵, R⁶ and n are each as defined above), or its reactive derivative at the amino group or the salt thereof, with a compound (IIIb):



(IIIb)

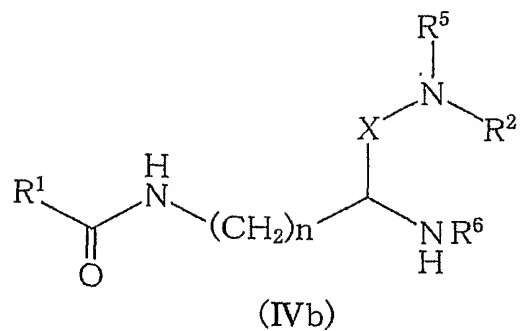
5

(wherein R¹ is as defined above), or its reactive derivative at the carboxy group or the salt thereof to give a compound (IVb):

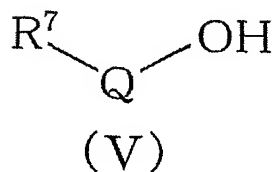


(IVb)

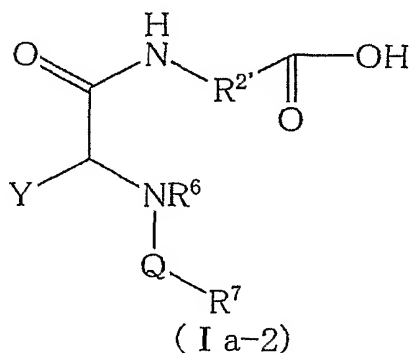
10 (wherein X, R¹, R², R⁵, R⁶, n and are as defined above), or its salt; and reacting the compound (IVb):



(wherein X, R¹, R², R⁵, R⁶ and n are as defined above),
or its salt, with a compound (V):



- 5 (wherein Q and R⁷ are as defined above), or its reactive derivative at the carboxy group (in case of Q is -CO-)/the sulfo group (in case of Q is -SO₂-), or the salt thereof.
- 10 8. A process for preparing the compound of the formula (Ia-2):



wherein
Y is

(1) lower alkyl, or

(2) $Z-(CH_2)_n-$,

{wherein

Z is

(1) aryl, or

(2) $R^1-CO-NR^4-$

{wherein

R^1 is (1) aryl, heterocyclyl,

aryl-(lower alkyl),

aryl-(lower alkoxy), or

heterocyclyl-(lower alkoxy),

each of which may be substituted

with one or more substituent(s)

selected from the group

consisting of

(a) lower alkyl,

(b) halogen and

(c) hydroxy; or

(2) lower alkoxy; and

R^4 is hydrogen, or lower alkyl); and

n is 1, 2, 3, 4, 5 or 6};

Q is $-CO-$ or $-SO_2-$;

$R^{2'}$ is (1) lower alkyl, (lower alkyl)thio-(lower alkyl)
or aryl-(lower alkyl); or

(2) aryl which may be substituted with

lower alkyl, lower alkenyl, aryl,

lower alkoxy, (lower alkyl)amino,

(lower alkyl)thio,

(lower alkoxy)-(lower alkyl),

(lower alkyl)amino-(lower alkyl), or

[(lower alkyl)thio]-(lower alkyl);

R^6 is hydrogen or lower alkyl; or

R⁶ and Y may be linked together to form -(CH₂)_m- (m is 2, 3, 4 or 5);

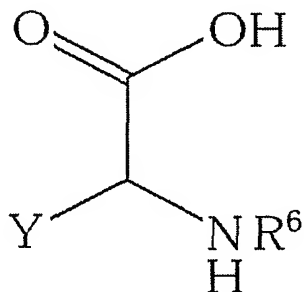
- 5 R⁷ is (a) lower alkyl which may be substituted with one or more substituent(s) selected from the group consisting of
- 10 cycloalkyl,
aryl which may be further substituted with aryl(s), and
heterocyclyl,
- (b) lower alkenyl which may be substituted with one or more substituent(s) selected from the group consisting of aryl and heterocyclyl,
- 15 (c) cycloalkyl,
- (d) aryl which may be substituted with one or more substituent(s) selected from the group consisting of
- 20 lower alkyl,
aryl which may be further substituted with hydroxy(s),
lower alkoxy,
aryloxy,
hydroxy, and
- 25 halogen,
- (e) heterocyclyl which may be substituted with one or more substituent(s) selected from the group consisting of
- 30 lower alkyl,
aryl which may be further substituted with halogen(s), and
halogen,
- (f) aryloxy, or
- 35 (g) amino which may be substituted with aryl(s) which may be substituted with one or more

substituent(s) selected from the group consisting of aryl and heterocyclyl];

or a pharmaceutically acceptable salt thereof,

5

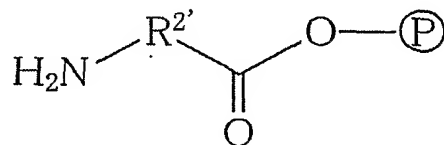
comprising, reacting a compound (IIa):



(IIa)

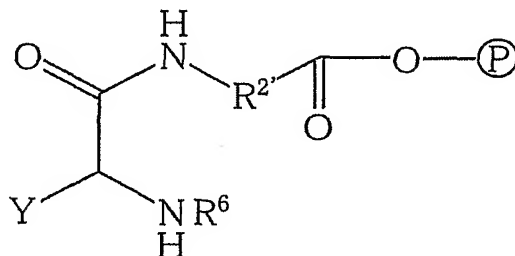
(wherein Y and R⁶ are each as defined above), or its reactive derivative at the carboxy group or the salt thereof, with a resin-bound compound (IIIc):

10



(IIIc)

(wherein R^{2'} is as defined above, and P is polymer), or its reactive derivative at the amino group or the salt thereof to give a compound (IVc):



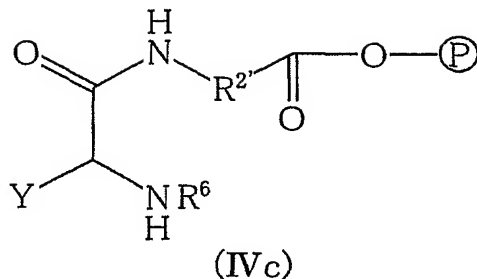
(IVc)

15

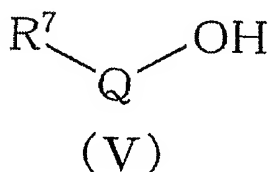
(wherein Y, P, R^{2'} and R⁶ are as defined above), or its

salt; .

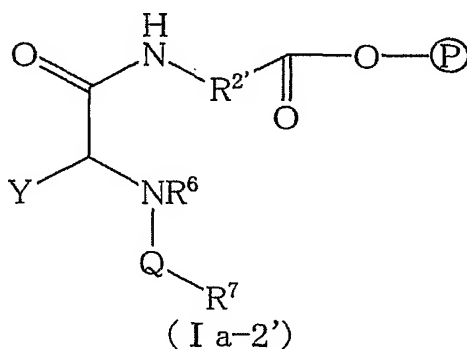
reacting the compound (IVc):



5 (wherein Y, \textcircled{P} , $\text{R}^{2'}$ and R^6 are as defined above), or its salt, with a compound (V):

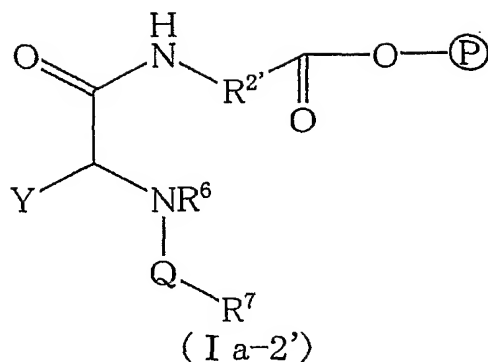


10 (wherein Q and R^7 are as defined above), or its reactive derivative at the carboxy group (in case of Q is -CO-)/the sulfo group (in case of Q is -SO₂-), or the salt thereof to give a compound (Ia-2'):



(wherein Q, Y, \textcircled{P} , $\text{R}^{2'}$, R^6 , and R^7 are as defined above), or its salt; and

15 subjecting the compound (Ia-2'):



(wherein Q, Y, P, R^{2'}, R⁶, and R⁷ are as defined above),
or its salt to a cleavage reaction of the resin.

- 5 9. A compound of any one of Claims 1 to 5 for use as a medicament.
- 10 10. The compound of Claim 9 for use in the treatment and/or prevention of PGE₂ mediated diseases in human beings or animals.
- 11 11. A medicament comprising a compound of any one of Claims 1 to 5 as an active ingredient.
- 15 12. A pharmaceutical composition comprising a compound of any one of Claims 1 to 5 as an active ingredient, in association with a pharmaceutically acceptable carrier or excipient.
- 20 13. An agonist or antagonist of PGE₂ consisting of a compound of any one of Claims 1 to 5.
- 25 14. A method for treatment and/or prevention of PGE₂ mediated diseases which comprises administering an effective amount of the compound of any one of Claims 1 to 5 to human beings or animals.

15. A method for treating or preventing kidney dysfunction, inflammatory conditions, various pains, collagen diseases, autoimmune diseases, various immunity diseases, analgesic, thrombosis, allergic disease, cancer or neurodegenerative diseases which comprises administering an effective amount of a compound of any one of Claims 1 to 5 to human beings or animals.
16. Use of a compound of any one of Claims 1 to 5 as a medicament.
17. Use of a compound of any one of Claims 1 to 5 as an agonist or an antagonist of PGE₂-sensitive receptor.
18. Use of the compound of any one of Claims 1 to 5 for treatment and/or prevention of PGE₂ mediated diseases in human beings or animals.
19. A commercial package comprising the pharmaceutical composition containing the compound identified in any one of any one of Claims 1 to 5 and a written matter associated therewith, wherein the written matter states that the compound (I) can or should be used for preventing or treating PGE₂ mediated diseases.